Camp Lick Project

Rare Plant Report

prepared by:

Amanda Hardman
Botanist

for:

Blue Mountain Ranger District
Malheur National Forest

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Introduction

This biological evaluation reviews potential effects or impacts from the proposed actions and alternatives to plant species in the Camp Lick planning area that are: (1) listed as threatened, endangered, or proposed for federal listing under the Endangered Species Act of 1973 as amended, (2) designated as sensitive (USDA 2008) by the Regional Forester of the Pacific Northwest Region, or (3) identified as species of local conservation concern and/or considered indicators of local biodiversity hotspots.

There are currently 144 species of rare plants, fungi, and/or lichens that are documented or suspected to occur on the Forest (Camp Lick Rare Plant Report Appendix 1). There are no species that are federally-listed or proposed for federal listing. Forty-six species are documented on the Forest and 94 are suspected. These species shall be collectively referred to as "rare plants" in this report.

Regulatory Framework

This report follows Forest Service policy to "review all planned, funded, executed, or permitted programs and activities for possible effects on endangered, threatened, proposed, or sensitive species" through the biological evaluation process. A biological evaluation (BE) is the means of conducting the review and documenting the findings (FSM 2672.4). The objectives of a BE (as defined in FSM 2672.41) are:

- To ensure that Forest Service actions do not contribute to loss of viability of any native or desired non-native plant or contribute to animal species or trends toward Federal listing of any species.
- To comply with the requirements of the Endangered Species Act, that actions of Federal agencies not jeopardize or adversely modify critical habitat of federally-listed species.
- To provide a process and standard by which to ensure that threatened, endangered, proposed, and sensitive species receive full consideration in the decision making process.

Furthermore, this document is consistent with the Malheur National Forest Land and Resource Management Plan (Malheur Forest Plan) of 1990, which requires "a biological evaluation for use in planning proposed projects when sensitive species are present or suspected to be present" (USDA Forest Service 1990, Forest-wide standard 66, page IV-33). It also fulfills, in part, requirements of the National Environmental Policy Act (NEPA) of 1969 which directs federal agencies to "... insure that environmental information is available to public officials and citizens before decisions are made and before actions are taken" [40 CFR §1500.1(b)].

Resource Elements, Indicators, and Measures

The resource elements used in this botany biological evaluation are the integrity of known rare plant populations and habitats.

Issue Statements

Direct physical disturbance and indirect consequences of disturbance have the potential to disrupt or reduce the integrity of rare plant populations and habitats by destroying individual plants or by altering the distinctive characteristics of the habitat. Additionally, creating bare ground would leave the habitat vulnerable to non-native invasive plant infestation. However, project design criteria (PDCs) should prevent direct ground disturbance and canopy cover changes in rare plant populations and habitats.

Table 1. Resource element, indicator, and measure for assessing effects to rare plants

Resource element	Resource indicator	Measure	Indicator source
Known rare plant populations	Integrity of populations	Potential impacts to integrity	FSM chapter 2670; USDA Departmental Regulation 9500-4; USDA Forest Service 1990, Forest-wide standards 56 and 62, pages IV-31 and IV-32
Rare plant habitats	Integrity of habitats	Potential impacts to integrity	FSM section 2672.4; USDA Forest Service 1990, Forest-wide standards 56 and 57, page IV-31

Known Rare Plant Populations

Affected Environment

Methodology

Pre-field Review: Existing Populations and Surveys for Sensitive Plant Species

A pre-field review was conducted to determine the probability that sensitive plant populations, and potential sensitive plant habitat, are located within, or adjacent to, the planning area. This information was used to determine the need for, and intensity of, botanical surveys.

The following sources of information were used to determine which species, and their respective habitats, may occur within, or adjacent to, the planning area:

- USFS Region 6 Sensitive Species List (USDA Forest Service 2015b).
- GIS mapping layers (vegetation, streams and wetlands, aerial imagery).
- Project GIS layers showing potential activity units.
- "Field Guide to Sensitive Plants of the Malheur National Forest" (USDA Forest Service 2015a). Information includes associated habitats, species distributions, key identification characters, photos, and drawings.
- United States Department of Interior Fish and Wildlife Service (USDI FWS) website. This website identifies which federally listed, proposed, and candidate species occur in each county of each state. This website was queried to determine which federally listed, candidate, and proposed plant species may occur in Grant and Malheur counties, Oregon (USDI FWS 2015).
- Forest Service Natural Resource Manager database (USDA Forest Service 2014). This database includes information on where botanical surveys and known sensitive plant populations are documented. This database was queried to determine where populations of sensitive plants are known within, and adjacent to, the planning area.
- Rare, threatened and endangered species of Oregon list (Oregon Biodiversity Information Center 2015).

The majority of botany surveys for rare plants were conducted according to standard Forest Service procedures (USDA Forest Service 2008) in the planning area during the summer of 2014. Surveys were done using the intuitive control technique. Areas that were determined to have the highest probability of sensitive plant occurrence were targeted as the first priority for surveys. Next, surveys were focused on areas where it was anticipated that ground disturbing activities may occur. Additional surveys were conducted in representative areas of various habitat types in the planning area. Areas that may be proposed only for prescribed burning were generally not surveyed. Due to the large size of the planning area, not all areas of potential disturbance were

surveyed. Therefore, there is a possibility that there are additional undiscovered populations of rare plants within the planning area. Selected high probability areas with potential for ground disturbance would be surveyed before project implementation. If sensitive plants are found, project design criteria for botany would be applied. If necessary, additional mitigations for protection would be developed.

Existing Condition

A diversity of habitats in the planning area have been surveyed for vascular plant, bryophyte, and lichen species. Habitats include riparian/wetland areas, meadows, rock outcrops, aspen stands, and upland forests.

Threatened, Endangered, Proposed, and Sensitive Plants

A total of four rare vascular plant species were located within the Camp Lick planning area, which consists of approximately 40,000 acres on the Blue Mountain Ranger District (Table 2).

Table 2. Existing rare plant occurrences

Scientific name (common name)	Conservation status	Local habitat requirements	Populations within planning area
Eleocharis bolanderi Bolander's spike-rush	Globally vulnerable throughout range (G3); critically imperiled in Oregon (S1).	Open, vernally wet depressions; moist meadows, lithosols, intermittent streams.	1 site in the NW part of the planning area and 1 to the southwest.
Penstemon deustus var variabilis hot rock penstemon	Globally stable (G5) but imperiled to critically imperiled in Oregon (S1S2).	On shallow soils in dry foothills and lowlands.	1 site just west of the West Fork Lick Creek.
Phacelia minutissima dwarf phacelia	Globally vulnerable throughout range; critically imperiled in Oregon.	Moist and ephemerally wet open habitats.	1 site at the southernmost tip of the planning area.
Trifolium plumosum ssp. Plumosum pussy clover	Globally stable (G4) but only 3 sites on the Malheur National Forest.	Dry hillsides and meadows.	1 site along West Fork Lick Creek.

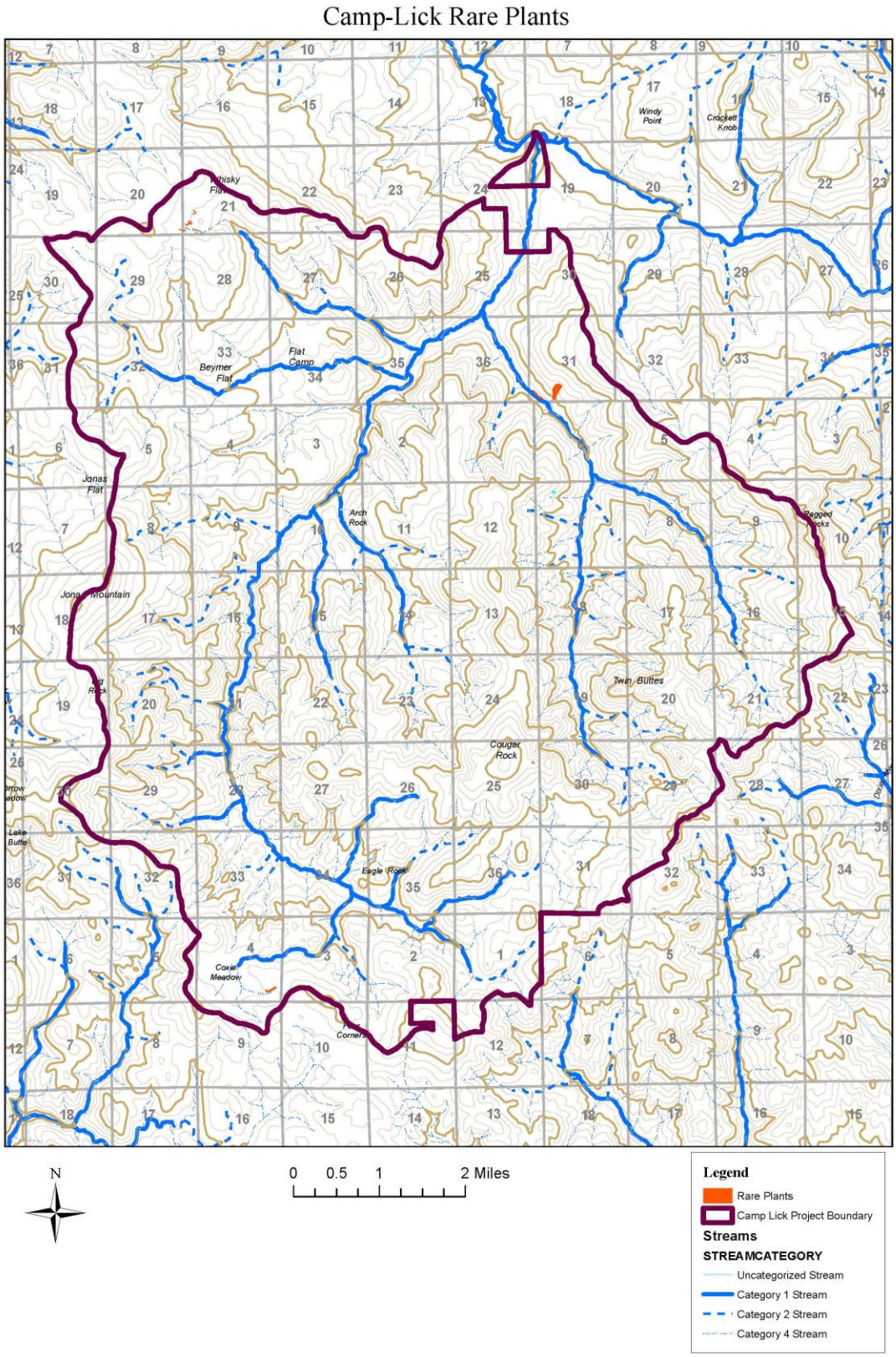

Figure 1. Map of rare plant locations in the Camp Lick planning area

Desired Condition

The Malheur Forest Plan does not explicitly define any desired conditions for rare plants, but it does have a goal to "provide a diversity of habitats sufficient to maintain viable populations of all species." Furthermore, the R6 2005 Preventing and Managing Invasive Plants Record of Decision (R6 2005 ROD) added the following desired future condition statement to the Malheur Forest Plan (USDA Forest Service 1990): "... healthy native plant communities remain diverse and resilient, and damaged ecosystems are being restored. High quality habitat is provided for native organisms throughout the [Forest]."

Environmental Consequences

Methodology

The following assumptions were used to guide the determination of environmental consequences (effects or impacts):

Species are given a "no impact" (NI) determination if: (1) they are not suspected in the project because the project is outside of the potential distribution and range of the species, (2) the required habitat is not present within the planning area, or (3) none of proposed actions or alternative actions would occur in or immediately adjacent to existing populations or potential habitats, and thus would not affect the integrity of the populations or habitats [40 CFR §1508.8, FSM 2672.42(5)].

Species are given a determination of "beneficial impact" (BI) if they could be favorably affected by a particular action or alternative [40 CFR §1508.8, FSM 2672.42(5)].

A determination of "may detrimentally impact, but will not lead to a trend toward federal listing" (MDI) is given for species that could possibly be negatively affected by any of the alternatives [40 CFR §1508.8, FSM 2672.42(5)]. This acknowledges that the action could have negative impacts to the integrity of the populations or habitats, but due to: (1) the complexity of the proposed action, (2) the differential impacts across the landscape, and (3) the lack of best available science, the degree and consequence of the negative impacts are not known with certainty. Additionally, this recognizes that even the most substantial impacts of the proposed action would not contribute to a trend toward listing the species under the Endangered Species Act.

Incomplete and Unavailable Information

Landscape scale analysis does not allow for detailed site-specific plant surveys. Most surveys for this project were done before specific ground disturbing activities had been proposed. It is possible that activities may be implemented in areas that would not be surveyed. Therefore, it is possible that there may potentially be impacts to undiscovered populations of sensitive plants.

There are 11 sensitive fungi species currently suspected on the Malheur National Forest (Camp Lick Rare Plants Report Appendix 1). Fungi only fruit under very specific moisture and temperature conditions. Six of the suspected species are hypogeous, meaning they fruit underground. Therefore, it is very difficult to locate species of fungi due to their ephemeral or hidden nature. It is possible there are undocumented populations of fungi in the planning area.

Some sensitive plant species do not produce above-ground plants every year. These plants include some grape-ferns (*Botrychium spp.*), and many annual species which are dependent upon sufficient early spring rains. Some of the annual sensitive species include least phacelia (*Phacelia*

minutissima), disappearing monkey flower (*Mimulus evanescens*), dwarf evening-primrose (*Camissonia pygmaea*), annual muhly grass (*Muhlenbergia minutissima*), lowland tooth-cup (*Rotala ramosior*), and desert chaenactis (*Chaenactis xantiana*). It is therefore possible that surveys may not detect these plants in years when conditions do not favor germination.

Some species, such as the least phacelia, annual muhly grass, and grapeferns, are so tiny and difficult to find in dense vegetation that even expert botanists may overlook them during surveys. Many of the non-vascular plants are very difficult to identify; it is possible that botanists may also overlook some of these species. For these reasons, it is not possible to state with 100 percent certainty that all sensitive plant species would be detected during sensitive plant surveys.

There are no empirical studies on the impacts of logging, burning, or grazing to most sensitive plant species that occur on the Malheur National Forest. The strategy for management of known populations has generally been avoidance of activities that may impact populations. Therefore, all discussion of potential impacts to sensitive plant populations and habitat is based upon general experience and inferred responses based upon observations and studies of more common species.

Spatial and Temporal Context for Effects Analysis

The spatial context for effects analysis includes locations for all documented rare plant occurrences and each of the proposed units of the proposed action. The temporal context includes the timeframe when the proposed actions would occur and the foreseeable future after the operations cease.

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects

In the past, present, and reasonably foreseeable future, there have been, and will continue to be, projects and activities within the planning area that may cause impacts to sensitive plants and their habitats. Projects and activities that create ground disturbance, change vegetative composition, and change domestic animal grazing patterns may potentially cause detrimental impacts to sensitive plant populations and habitats. These actions include road construction, timber harvest, fuels reduction treatments (landscape and pile burning, lopping and scattering of slash), fire suppression, recreation development, mining, and livestock grazing. In addition, restoration efforts such as road decommissioning and stream improvements may also potentially impact sensitive plant populations and habitat. Road construction and recreation developments have permanently altered native plant habitats in limited areas of the planning area.

Livestock grazing has occurred in most of the planning area for decades and has resulted in changes in plant communities, especially in non-forested and riparian areas. Grazing has a direct effect on plants through plant herbivory and trampling. Grazing can have an indirect effect on plant species by causing changes in shade, soil compaction, soil disturbance, smothering by cow pies, and alteration of nutrient cycling. The degree of impact to plant species from grazing is related to the timing, duration, and intensity of the grazing action, as well as the individual characteristics and habitat requirements of the species. Grazing will continue to occur in the planning area.

The historical abundance and distribution of sensitive species on the Forest is not known. Past activities have likely affected their current abundance and distribution. Beginning in approximately 1990, botanical surveys and biological evaluations were conducted for most Forest Service projects planned and implemented on the forest. As a result, activities conducted since 1990 have been designed to reduce impacts to sensitive species.

Project Design Criteria and Mitigation Measures

Table 3. Project design criteria

Criteria Number	Objective	Design criteria	Responsible Person
Botany–1	Protect rare plants	All rare and sensitive plant populations shall be avoided and buffered 100 feet from all operational activities. Sensitive plant sites and associated buffers shall be identified as areas to protect (ATPs). Operational activities include, but are not limited to, vehicle and heavy equipment operation, road construction, staging areas, stockpile areas, landings, piling of slash, recreation developments, prescribed fire, and fire line construction. A Forest Service botanist shall be consulted prior to implementation of activities within 200 feet of ATPs; notification will occur at least two weeks prior to implementation for activities to be implemented in the summer or late spring, and the summer or fall prior to implementation for activities to be implemented during the winter or early spring. The botanist may flag the site, and/or help lay out in the field the location of nearby skid trails, landings, and roads. Applies to: Vehicle and heavy equipment operation, road construction, staging areas, stockpile areas, landings, piling of slash, recreation developments, prescribed fire, and fire line construction. Units: 134, 138, 141, 190, 194, 221.	Botanist, sale administrator, contracting officer's representative (COR)
Botany–2	Protect rare plants	If any new rare or sensitive plant populations are located before or during project implementation, the population will be evaluated and a mitigation plan shall be developed in consultation with the botanist. Applies to: All units.	Botanist

Alternative 1 – No Action

Direct and Indirect Effects

Under the no action alternative, no disturbance from project activities would take place. Therefore selection of alternative 1 would have no direct or indirect effects to sensitive species assumed present in the planning area.

However, impacts may still occur due to ongoing activities and natural processes. Grazing, off-road driving, firewood collecting, and fire suppression are all ongoing activities that will continue even if the no action alternative is selected for this project. In addition, forest and grassland succession, non-native plant invasion, erosional processes, and wildfires may also lead to direct and indirect impacts to sensitive plants. It would be speculative to try to predict how these naturally occurring events would potentially impact plant species.

Cumulative Effects

There would be no cumulative effects because there would be no direct or indirect effects.

Alternative 2 – Proposed Action

Direct and Indirect Effects to Federally Listed, Proposed and Candidate Plant Species

There are no known populations or potential habitat for any federally listed, candidate, or proposed plant species in the planning area. Therefore, this project would have no effect to any federally listed, proposed, or candidate plant species. Consultation with the U.S. Fish and Wildlife Service is therefore not required for this project for rare plants.

Direct and Indirect Effects to Known Sensitive Plant Populations

All known populations of sensitive plants would be buffered from all ground disturbing activities. Some populations may be subject to prescribed burning. However, the project design criteria prescribe that a botanist be consulted before burning occurs in areas with known sensitive plant populations. These protections should adequately ensure that there are no direct or indirect impacts from project activities to the known populations of sensitive plants. Therefore, there would be **no impact (NI)** to known populations of sensitive plants from project activities associated with alternative 2.

Cumulative Effects

Cumulative effects are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions" (40 CFR 1508.7). The geographic scale considered for cumulative effects is the planning area. This is due to the fact that plant populations generally do not move significantly over time. The time scale for this cumulative effects analysis from 150 years ago (when Euro-Americans arrived in the area) to 10 years into the future. It is not possible to anticipate Forest Service activities beyond this time.

See the discussion above on past, present, and foreseeable activities relevant to cumulative effects for details of activities that may contribute to cumulative effects for sensitive plants.

It is highly likely that historical activities, such as grazing, timber harvest, mining, road construction, and fire suppression have destroyed populations, and have altered habitats for sensitive plants. However, these historical effects are not quantifiable because the details of historical activities and the historical existing conditions of sensitive plants are not known.

Climate change effects may be considered as a component of cumulative impacts. Changes in climate influence vegetation, water, and disturbance frequencies, and these changes, in turn, influence one another. A change in one aspect causes a cascade of responses that in some cases counteract, and in others magnify the initial change. Such interactions make prediction of the likely effects of climate change difficult at the scale of the analysis area even if the nature of the climate change at the local scale were known. At this point one can be certain that changes will occur at a continental scale, yet we do not know the mode, timing, or magnitude of those changes or environmental responses at the project scale. Until these changes are better understood, it is difficult to reliably predict the environmental outcomes of particular land-use activities. Species most at risk of climate change are those with small geographic ranges (e.g., local endemics, locally rare species), narrow physiological tolerances, limited dispersal abilities, strong interspecific dependencies, low genetic diversity, and those that have recently experienced population declines. Attempts to quantify the degree of change would be speculative at this point. Tools to predict the potential climatic changes as influenced by vegetation management activities over the next 10 to 15 years have yet to be devised, but it seems unlikely that measurable changes would occur relative to sensitive plant species over the life of this project.

Since 1990, protection and management of sensitive species and their habitats (in the form of project design criteria, avoidance, or other mitigation) have been included in the design of all projects (following Forest-wide standards 56, 62, 65, and 66, and standards for Management Areas 3A and 3B in the Malheur Forest Plan; and in direction and policy set forth in the FSM 2670). This has, and will continue to, reduce the potential of cumulative effects to sensitive plant populations and habitats.

Direct and indirect effects to sensitive plant habitats have been described above. The determination of **no impact (NI)** was made for known populations of sensitive plants in the planning area. There are no current plans to conduct vegetation management activities in this area beyond the scope of this project for the next 10 years. Therefore, this project, foreseeable future projects, and those that have occurred in the recent past, are not likely to contribute toward cumulative detrimental impacts to sensitive plant species.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

This project complies with Forest Service policy (FSM 2670.32) to: (1) review activities as part of the National Environmental Policy Act of 1969 to determine their potential effect on sensitive species, (2) avoid or minimize impacts to species whose viability has been identified as a concern, and (3) assure that decisions would not result in loss of species viability or create significant trends toward federal listing.

Monitoring Recommendations

Project design criteria should provide sufficient protection to known sensitive plant populations and potential habitat in the planning area. However, implementation monitoring is recommended for the three sensitive plant populations in this planning area. This would include site visits to populations during and after project implementation. This would help insure that project design criteria were implemented. It would also allow an opportunity to confirm that the assumptions used for development of the project design criteria are correct. For example, a revisit to areas buffered a certain distance from activities would confirm the distance is sufficient to prevent blow down, or unacceptable changes in hydrology or sunlight.

Known Rare Plant Habitats

Affected Environment

Methodology

Existing Rare Plant Habitat and Surveys for Sensitive Plant Species within Those Habitats

A pre-field review was conducted to determine the probability that sensitive plant habitats, are located within, or adjacent to, the planning area. This information was used to determine the need for, and intensity of, botanical surveys.

The following sources of information were used to determine which species, and their respective habitats, may occur within, or adjacent to, the planning area:

- USFS Region 6 Sensitive species list (USDA Forest Service 2015b).
- GIS mapping layers (vegetation, streams and wetlands, aerial imagery).
- Project GIS layers showing potential activity units.
- “Field Guide to Sensitive Plants of the Malheur National Forest” (USDA Forest Service 2015a). Information includes associated habitats, species distributions, key identification characters, photos, and drawings.
- United States Department of Interior Fish and Wildlife Service (USDI FWS) website. This website identifies which federally listed, proposed, and candidate species occur in each county of each state. This website was queried to determine which federally listed,

candidate, and proposed plant species may occur in Grant and Malheur counties, Oregon (USDI FWS 2015).

- Forest Service Natural Resource Manager database (USDA Forest Service 2014). This database includes information on where botanical surveys and known sensitive plant populations are documented. This database was queried to determine where populations of sensitive plants are known within, and adjacent to, the planning area.
- Rare, threatened and endangered species of Oregon list (Oregon Biodiversity Information Center 2015).

Rare plants are generally associated with particular habitats, therefore targeting those rare plant habitats for surveys can increase chances of finding rare species. Surveys were conducted according to standard Forest Service procedures (USDA Forest Service 2008) in the planning area during the summer of 2014. Surveys were done using the intuitive control technique. Areas that were determined to have the highest probability of sensitive plant occurrence were targeted as the first priority for surveys. Next, surveys were focused on areas where it was anticipated that ground disturbing activities may occur. Additional surveys were conducted in representative areas of various habitat types in the planning area. Areas that may be proposed only for prescribed burning were generally not surveyed. Due to the large size of the planning area, not all areas of potential disturbance were surveyed. Therefore, there is a possibility that there are additional undiscovered populations of rare plants within the planning area. Selected high probability areas with potential for ground disturbance would be surveyed before project implementation. If sensitive plants are found, project design criteria for botany would be applied. If necessary, additional mitigations for protection would be developed.

Existing Conditions

Rare plants are generally associated with specific habitat types. Major habitats occurring within the planning area include upland coniferous forest, aspen stands, lithosols, sagebrush shrublands, grasslands, cliffs, rock outcrops, talus, and riparian dependent habitats. Some of these are biodiversity hotspots because their unique environmental conditions have promoted occupation by unique and rare plants.

Of the above habitat types some of the more sensitive habitats include: lithosols (scablands), cliff/talus habitat, aspen stands, springs and seeps, and intermittent and perennial streams.

Lithosols

Lithosols are habitats with very shallow soils on poorly weathered basalt or andesitic bedrock. This habitat type has often been called scabland. While the soils can be saturated following spring snow melt, they dry quickly and are exposed to full sun for the entire growing season. Plants adapted to this harsh environment usually bloom and fruit early in the growing season. Basalt lithosols can be found in the dry upland shrubland potential vegetation group, and the dry upland herbland potential vegetation group. Basalt lithosols may also be found as small inclusions within a larger matrix of grasslands and shrublands.

Given the low productivity and discontinuous fuels in this habitat group, fire has probably burned at low intensities and infrequently in this habitat type. However, when invaded with non-native grasses such as medusahead and African hair-grass, fuel levels can increase to a level where fire carries better, damaging and increasing mortality of native plants, and/or decreasing the quality of the native plant communities and sensitive species habitat.

There are several sensitive plant species that may occur in lithosol habitats, including *Eleocharis bolanderi, Eremothera pygmaea*, and *Erigonum cusickii*. Many culturally significant plant species occur in this habitat type as well including *Balsamorhiza sagittata, Lomatium nudicaule,* and *Perideridia gairdneri.* Biological soil crusts include a collection of lichens, bryophytes algae, micro-fungi, and cyanobacteria that are extremely sensitive to ground disturbance, also occur in this habitat. *Texosporium sancti-jacobi* is an extremely rare biological crust species that can be found growing in lithosol habitats.

Cliffs, Rock Outcrops, and Talus

Cliffs and rock outcrops have vertical faces where generally unique species of plants are adapted. Talus is accumulated boulders and cobbles at the base of cliffs or on steep slopes. Because these habitats are largely composed of bedrock or accumulations of rock, they are assumed to be in good condition with a stable trend. The nature of this habitat group means it is resistant to management activities or has been avoided with most management activities. The main exception to this is when these areas are used for rock sources.

Some of the species adapted to live in this habitat type include: *Cheilanthes feei, Encalypta brevipes, Lophozia gillmanii, Pellaea bridgesii, Phlox multiflora,* and *Pressia quadrata.*

Fire is likely only carried at very low levels through this habitat type. Like lithosols, the native plant communities of cliffs, rock outcrops, and talus slopes often lack sufficient fuel to carry fire.

Springs and Seeps

Springs are points where groundwater emerges and flows. Groundwater also feeds seeps, but seeps do not produce perennial flow. Springs and seeps are typically small, but are well distributed on the Malheur National Forest. Fens are a unique habitat. Many springs are mapped in GIS. Seeps are generally less well documented on the Forest. Seeps and springs are often developed for cattle troughs. Many of these areas have been dewatered and/or trampled due to these developments historically. Many developed springs now have fences to protect the water source. These areas provide important habitat for several sensitive mosses and liverworts such as: *Elodium blandowii*, *Jungermannia polaris*, *Meesia uliginosa, Pseudocalliergon trifarium, Splachnum ampullaceum,* and *Tomenthypnum nitens.*

It is unlikely that fire carried over these spring and seep habitats in the planning area due to their generally saturated soils and moist microclimate within the greater landscape.

Aspen Stands

Aspen is a widespread but uncommon species that is shade intolerant. Aspen stands have been declining in the Blue Mountains because regeneration has been greatly reduced by herbivory and competition from conifers (Shirley and Erickson 2001). Aspen conservation may include fencing, mechanical removal of conifers, burning, and other methods to stimulate aspen sprouting. Frequent low severity fire that can kill young conifers and stimulate aspen suckering may be beneficial but stands with larger diameter, fire tolerant conifers often fail to promote aspen success. Some discretion should be made for cutting all the older conifers in aspen stands as large diameter conifers often host rare to uncommon calicioid lichens that are dependent on old trees.

Intermittent and Perennial Streams

Intermittent streams are channelized areas where water only runs part of the year. Most of the moisture in these streams comes from snowmelt runoff. These areas are classified as stream category 4 for riparian management standards and objectives. Perennial streams are channelized

areas where water flows all year long. These areas are classified as stream category 1 (fish-bearing) or stream category 2 (non-fish bearing). These habitat types are generally quite narrow on the Malheur National Forest; they often extend upslope less than 100 feet above the water level. In flatter areas, they transition into moist and wet meadow types. Streams on most portions of the Forest are dominated by riparian shrubs and trees.

Fire carries through riparian areas in varying intensities, dependent on fire behavior and availability of fuel (such as a thick riparian shrub component) along the water, and the topography of the valley bottom. Vegetation in riparian habitats after a fire often regenerate quickly because of availability of water and nutrients along the stream.

Desired Conditions

The Malheur Forest Plan does not explicitly define any desired conditions for rare plant habitats, but it does have a goal to "provide a diversity of habitats sufficient to maintain viable populations of all species." Furthermore, the R6 2005 Preventing and Managing Invasive Plants Record of Decision (R6 2005 ROD) added the following desired future condition statement to the Malheur Forest Plan (USDA Forest Service 1990): "... healthy native plant communities remain diverse and resilient, and damaged ecosystems are being restored. High quality habitat is provided for native organisms throughout the [Forest]."

Environmental Consequences

Methodology

The following assumptions were used to guide the determination of environmental consequences (effects or impacts):

Habitats are given a "no impact" (NI) determination if: (1) they are not suspected in the planning area, (2) none of proposed actions or alternative actions would occur in or immediately adjacent to potential habitats, and thus would not affect the integrity of the populations or habitats [40 CFR §1508.8, FSM 2672.42(5)].

Habitats are given a determination of "beneficial impact" (BI) if they could be favorably affected by a particular action or alternative [40 CFR §1508.8, FSM 2672.42(5)].

A determination of "may detrimentally Impact, but will not lead to a trend toward federal listing" (MDI) is given for habitats hosting species that could possibly be negatively affected by any of the alternatives [40 CFR §1508.8, FSM 2672.42(5)]. This acknowledges that the action could have negative impacts to the integrity of the populations or habitats, but due to: (1) the complexity of the proposed action, (2) the differential impacts across the landscape, and (3) the lack of best available science, the degree and consequence of the negative impacts are not known with certainty. Additionally, this recognizes that even the most substantial impacts of the proposed action would not contribute to a trend toward listing the species found in those habitats under the Endangered Species Act.

Incomplete and Unavailable Information

Large landscape scale restoration projects do not allow for completely thorough investigations on the ground. Most surveys for this project were done before specific ground disturbing activities had been proposed. Surveys are prioritized by habitats most likely to host rare species. Dry, upland coniferous forests are some of the least likely places to find rare plants so these areas are not as thoroughly surveyed as higher potential habitats, such as the riparian dependent areas. It is

possible that activities may be implemented in areas that were not surveyed. Therefore, it is possible that there may potentially be impacts to undiscovered populations of sensitive plants within some habitats.

Spatial and Temporal Context for Effects Analysis

The spatial context for effects analysis includes locations for all inventoried rare plant habitats, and each of the proposed units in alternative 2. The temporal context includes the timeframe when the proposed actions would occur and the foreseeable future after the operations cease.

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects

In the past, present, and reasonably foreseeable future, there have been, and will continue to be, projects and activities within the planning area that may cause impacts to sensitive plants and their habitats. Projects and activities that create ground disturbance, change vegetative composition, and change domestic animal grazing patterns may potentially cause detrimental impacts to sensitive plant populations and habitats. These actions include road construction, timber harvest, fuels reduction treatments (landscape and pile burning, lopping and scattering of slash), fire suppression, recreation development, mining, and livestock grazing. In addition, restoration efforts such as road decommissioning, and stream improvements may also potentially impact sensitive plant populations and habitat. Road construction and recreation developments have permanently altered native plant habitats in limited areas of the planning area.

Livestock grazing has occurred in most of the planning area for decades and has resulted in changes in plant communities, especially in non-forested and riparian areas. Grazing has a direct effect on plants through plant herbivory and trampling. Grazing can have an indirect effect on plant species by causing changes in shade, soil compaction, soil disturbance, smothering by cow pies, and alteration of nutrient cycling. The degree of impact to plant species from grazing is related to the timing, duration, and intensity of the grazing action, as well as the individual characteristics and habitat requirements of the species. Grazing will continue to occur in the planning area.

The historical abundance and distribution of sensitive species on the Forest is not known. Past activities have likely affected their current abundance and distribution. Beginning in approximately 1990, botanical surveys and biological evaluations were conducted for most Forest Service projects planned and implemented on the forest. As a result, activities conducted since 1990 have been designed to reduce impacts to sensitive species.

Project Design Criteria and Mitigation Measures

Table 4. Project design criteria

Criteria number	Objective	Design criteria	Responsible person
Botany–3	Protect unique and sensitive plant and animal habitats; protect undocumented rare plants	The integrity of unique habitats shall be maintained. Unique habitats may include meadows, lithosols (scablands), rimrock, talus slopes, cliffs, wallows, bogs, fens, seeps and springs. Operational activities (see Botany–1) shall avoid these areas (with the exception of prescribed fire). This shall be accomplished by incorporating cover buffers of approximately 100 feet from unit boundaries and landings. Applies to: Meadows, lithosols (scablands), rimrock, talus slopes, cliffs, wallows, bogs, fens, seeps and springs.	Layout crew, sale administrator, COR

Alternative 1 – No Action

Landscape scale restoration efforts are used to return habitats to pre-European contact conditions. Years of fire suppression has resulted in increased cover of conifers in aspen stands, creating competition and reducing aspen seedling success. Without restoration actions that can reduce conifer competition and promote aspen regeneration such as silvicultural treatments, prescribed burning, mechanical root stimulation, removal of competing vegetation, protection of regeneration from herbivory, and regenerating aspen from seed, aspen habitats are likely to continue to decline (Sheppard 2001).

Alternative 2 – Proposed Action

Direct and Indirect Effects

Impacts to forested and riparian and wetland habitats will be discussed at the broad habitat level. More specific habitats such as lithosols and cliffs will be discussed individually.

Potential Impacts to Coniferous Forest Communities

Vegetation management actions that may have direct impacts to sensitive plants in upland coniferous forested habitats include silvicultural treatments, upland watershed restoration treatment, biomass removal, and associated yarding, slash piling, grinding, or scattering, and application and control of prescribed burning. Potential detrimental direct impacts include the destruction of sensitive plants from ground disturbance associated with cutting and yarding of trees, piling or scattering slash.

Prescribed burning or slash pile burning could scorch sensitive plant individuals within the fire area, and also may kill plants under and directly adjacent to slash piles. Fire line construction has the potential to directly kill or dislodge sensitive plants in the area that is denuded. Natural fire generally occurs in mid to late summer. Much of the prescribed burning is done in spring or early summer, when plants are actively growing. It is unknown if burning sensitive plants when they are actively growing would cause more mortality than when they may be senescent later in the summer. Road maintenance, decommissioning, relocation, and new construction (of temporary roads) can directly kill or dislodge sensitive plants.

Indirect effects could result from altering the hydrologic regime and changing light intensity. Vegetation management may also alter the interaction of herbivores and plants. By opening up the canopy of the forest, grasses and other palatable plants may increase. This may in turn increase grazing activity in the treated areas. Conversely, logging-created slash may impede travel by ungulates. Road maintenance activities contribute to the movement of invasive species along road shoulders and ditches, and to and from quarry and waste disposal areas. Invasive species may potentially outcompete or prevent the recruitment of new sensitive plant populations. Project design criteria are included that should help to reduce the chance of increasing invasive plant abundance in the planning area. Closure of temporary roads should help to reduce these impacts in the long-term. The risk would only occur during the time that the sale is active, until the roads are reclosed or decommissioned. Initial monitoring of closed roads should be conducted to ensure that invasive species are not present after closing the road. The impacts of closing roads would be a **beneficial impact (BI)** as there would be reduced transport of invasive species and opportunity for the re-establishment of natives.

Many of the areas proposed for silvicultural treatments and, riparian and upland watershed restoration treatments, were not specifically surveyed for this project. Therefore, it must be assumed that undiscovered populations of sensitive plant species may be impacted. Since most sensitive plant species occur in specific microhabitats, the probability that sensitive plant species may occur in the planning area in these upland general forested habitats is relatively low. None of the sensitive plant species that may occur in coniferous forest habitats on the Malheur National Forest are extremely rare on a global scale. Therefore, even if project activities may impact individual plants or habitat, implementation of this alternative should not increase the need for Federal listing of any sensitive species. Therefore, the determination of effects for forested communities, and any sensitive plants that may occur there, for the proposed action (alternative 2) is: **may detrimentally impact, but will not lead to a trend toward federal listing (MDI).**

No impacts are expected from the erection of interpretive signs or range fence construction, as long as project design criteria are followed and construction is kept out of rare plant sites.

Potential Impacts to Aspen Communities

Treatments proposed in aspen stands include silvicultural treatments (with ground-based logging), and prescribed burning. Ground-disturbing activities, such as tractor logging, grapple piling, or tree tipping have high potential to detrimentally impact any undiscovered populations of sensitive plants in this habitat type. Prescribed burning could potentially kill sensitive plants in this habitat.

Indirect effects of the aspen stand treatments may include changes in light and water relationships, as well as changes to ungulate grazing patterns. Indirect effects of fire include changes in plant species composition, increases in non-native invasive plants, and erosion. Protection of selected aspen stands from grazing through fences, cages, and piling of brush and trees, is also proposed. This should help reduce the impact of grazing animals in these stands. This element of aspen treatments may have a long-term beneficial impact to any sensitive plants that may be present in aspen treatment areas.

Road activities, interpretive sign installation, and range fence construction are not proposed within aspen stands and thus there would be no direct or indirect effect to aspen communities. **No impact** would occur from riparian and upland restoration treatments because those actions would not occur within aspen stands.

None of the sensitive plant species that may occur in these habitats is considered to be extremely rare on a global scale. Therefore, even if project activities may impact individual plants or habitat, implementation of this alternative should not increase the need for Federal listing of any sensitive species**.** In the short-term, the proposed action (alternative 2) **may detrimentally impact, but will not lead to a trend toward federal listing (MDI)** for rare plants potentially found in aspen-dominated habitats.

Although there may be detrimental potential impacts to the habitat for the short-term due to ground disturbance, the long-term impacts to these areas may actually be beneficial. This is due to the fact that the aspen would be stimulated to grow new stems, the competing conifers would be removed, and the stands would be protected from ungulate grazing. Because the aspen stands would be rejuvenated and protected from cattle grazing in the long-term, alternative 2 should have a **beneficial impact (BI)** to sensitive plant species that occur within aspen stands.

Potential Impacts to Lithosols, Sagebrush Shrublands, and Grasslands

The main potential activity within this habitat type would be prescribed burning. Since these habitats have low fuel loads, and prescribed burning is usually done under low-intensity conditions, it is likely that fire would not kill most plants in these habitat types. In addition, the goal of sagebrush habitat improvement would discourage the intentional burning of sagebrush in these habitat types. Therefore, there is very little risk of detrimental impacts to these habitats due to burning.

Motorized equipment may be used to clear juniper and conifers in some lithosol areas. This would generally be done under winter conditions (over snow or frozen ground). This should reduce the chances of ground disturbance during the cutting and removal of the trees. The removal of shade and reduced water transpiration in these areas may improve the health of sagebrush and other plants in these habitat types.

Temporary road construction in these habitats may lead to detrimental direct effects such as plant excavation, and burial by dirt and gravel. Potential indirect effects of temporary road construction include increased vehicle use, increases in non-native invasive plants, and changes in water movement across the landscape. Road decommissioning and temporary road construction is planned across limited areas in these habitat types. Areas with high potential habitat for sensitive plants may be surveyed for rare plants before project implementation.

Project design criteria that protect “special” and sensitive plant habitat would provide a high level of protection to these habitats. The project design criterion that states “Pre-implementation monitoring of selected high probability habitats for sensitive plants may be conducted in specific areas of proposed activities” would ensure that temporary road construction or decommissioning does not impact undiscovered populations of sensitive plants in this habitat.

Bolander’s spike rush is a sensitive plant that occurs in sagebrush and grassland areas. The documented population in the planning area would be designated as an area to protect, and a botanist would be consulted before prescribed burning is implemented in the population. The buffering standards for protection of “special” habitats should reduce the chance of impacts to any undocumented populations of this or other sensitive plant species in the planning area.

Because the project design criteria would protect lithosol, sagebrush shrubland, and grassland habitats in the planning area, the implementation of alternative 2 should have **no impact (NI)** to lithosols, sagebrush shrublands, and grassland habitats, or to any sensitive species that may occur

in these habitats. Furthermore, riparian and upland watershed restoration treatments would not occur in Lithosols, Sagebrush Shrublands, and Grasslands so **no impact (NI)** would occur.

No impacts are expected from the erection of interpretive signs or range fence construction, as long as project design criteria are followed and construction is kept out of rare plant sites.

Potential Impacts to Cliffs, Rock Outcrops, and Talus

Very few human activities have potential for direct or indirect impacts to this habitat type. Prescribed burning generally does not burn in this habitat type, due to the low fuel levels. The main activity that may impact this habitat type is rock quarrying for use in temporary road construction and road maintenance. The removal of rocks could directly kill plants by excavating them. Quarrying may potentially indirectly impact this habitat by exposing roots of plants that are not directly removed.

Project design criteria that protect "special" plant habitats would provide a high level of protection to these habitats. The project design criterion that states "Pre-implementation monitoring of selected high probability habitats for sensitive plants will be conducted in specific areas of proposed activities" would lessen the chances that quarrying for road work would impact undiscovered populations of sensitive plants in this habitat.

Because the project design criteria would protect cliffs, rock outcrops, and talus in the planning area, the implementation of alternative 2 should have **no impact (NI)** to cliffs, rock outcrops, and talus habitats, or to any sensitive species that may occur there. Furthermore, there would be **no impact (NI)** from riparian and upland restoration treatments, sign installation, and range fence construction because these activities would not occur in cliffs, rock outcrops, or talus habitats.

Potential Impacts to Riparian-dependent Communities

The mechanisms for direct and indirect effects to riparian-dependent communities are similar to upland coniferous forest communities. See the discussion above related to potential direct and indirect impacts to coniferous forest communities for details of similar potential effects to riparian-dependent communities.

Project design criteria would need to be followed for rare plant populations that occur within riparian dependent communities. Those populations would need to be avoided where riparian habitat conservation area treatments involving heavy equipment have been proposed

There are three populations of sensitive plant species that occur in riparian-dependent communities within the planning area. Many of the botanical surveys conducted for this project focused on riparian-dependent communities. However, not every acre of riparian-dependent community was surveyed. Therefore, there may be undiscovered populations of sensitive plants in these areas.

None of the sensitive plant species that may occur in riparian-dependent habitats is considered to be extremely rare on a global scale. Therefore, even if project activities may impact individual plants or habitat, implementation of this alternative should not increase the need for Federal listing of any sensitive species. Therefore, the proposed action (alternative 2) **may detrimentally impact, but will not lead to a trend toward federal listing (MDI)** in riparian dependent habitats.

Cumulative Effects

See the discussion above on past, present, and foreseeable activities relevant to cumulative effects for details of activities that may contribute to cumulative effects for sensitive plants.

It is highly likely that historical activities, such as grazing, timber harvest, mining, road construction, and fire suppression have destroyed populations, and have altered habitats for sensitive plants. However, these historical effects are not quantifiable because the details of historical activities and the historical existing conditions of sensitive plants are not known.

Since 1990, protection and management of sensitive species and their habitats (in the form of project design criteria, avoidance, or other mitigation) have been included in the design of all projects (following Forest-wide standards 56, 62, 65, and 66, and standards for Management Areas 3A and 3B in the Malheur Forest Plan; and in direction and policy set forth in the FSM 2670). This has, and will continue to, reduce the potential of cumulative effects to sensitive plant populations and habitats.

Direct and indirect effects to sensitive plant habitats have been described above. The determination of **no impact (NI)** was made for lithosol, sagebrush, grassland, cliffs, rock outcrops, and talus habitats. Since there would be no impact to these resources, there would be no cumulative effects to those resources.

A determination of **may detrimentally impact, but will not lead to a trend toward federal listing (MDI)** was made for sensitive plant habitats that may occur in coniferous forest, aspen communities, and riparian dependent communities. Historically, there have most likely been detrimental impacts to sensitive plant habitat in these areas. Forest Service projects are designed to minimize impacts to these communities in the present and future. The potential for negative direct and indirect effects to these habitats from the proposed activities have been minimized through the use of project design criteria. There are no current plans to conduct vegetation management activities in this area beyond the scope of this project for the next 10 years. Therefore, this project, foreseeable future projects, and those that have occurred in the recent past, are not likely to contribute toward cumulative detrimental impacts to sensitive plant species.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

This project complies with Forest Service Policy (FSM 2670.32) to: (1) review activities as part of the National Environmental Policy Act of 1969 to determine their potential effect on sensitive species, (2) avoid or minimize impacts to species whose viability has been identified as a concern, and (3) assure that decisions would not result in loss of species viability or create significant trends toward federal listing.

Summary of Environmental Effects

Table 5. Summary of resource indicators and measures by alternative

Resource element and resource indicator	Measure	Alternative 1	Alternative 2
Known rare plant populations	Potential impacts to integrity of populations	No impact	No impact
Rare plant habitats	--	--	--

Resource element and resource indicator	Measure	Alternative 1	Alternative 2
Coniferous forest	Potential impact to habitat	No impact	May detrimentally impact
Aspen habitat	Potential impact to habitat	No impact	May detrimentally impact
Lithosols, sagebrush, shrublands, grasslands	Potential impact to habitat	No impact	No impact
Cliffs, outcrops, talus	Potential impact to habitat	No impact	No impact
Riparian habitat	Potential impact to habitat	No impact	May detrimentally impact

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Appendix 1: Malheur National Forest Sensitive Plants Suspected in the Planning Area

All of the following species are suspected or documented in the planning area. Detrimental Impacts to individuals or habitats are possible but activities are unlikely to contribute to a trend towards federal listing or cause a loss of viability to the population or species.

Table 6. Sensitive species suspected or documented in the planning area

Scientific name	Habitat
Fungi	**--**
Amanita armillariiformis	In xeric habitats with Artemisia, mustards, cheat grass, bluegrass, aspen, Douglas-fir, and scattered Salix.
Amanita malheurensis	In eastern Oregon associated with Artemisia, *Sarcobatus vermiculatus*, *Chrysothamnus nauseosus,* and *Myosurus aristata*.
Hydnotrya michaelis	Appears to grow in mid-montane to subalpine elevation coniferous forest.
Pseudorhizina californica	In coniferous forests on or adjacent to well-rotted stumps or logs, or on soil in rich rotted wood.
Rhizopogon semireticulatus	Mixed conifer forest.
Rhizopogon subclavitisporus	In duff under conifers.
Rhizopogon variabilisporus	Coniferous Abies, Pinus, and Picea, mostly at high elevations. Fruits late summer.
Sclerotinia veratri	Not yet known from the Pacific Northwest. Moist meadows and wet areas growing on stems of rotting *Veratrum* spp. just after spring snowmelt.
Lichens	**--**
Collema curtisporum	Epiphyte on *Populus balsamifera* ssp. *trichocarpa* trees at mid to high elevations.
Peltula euploca	Grows on noncalcareous rock, in exposed, dry, or shaded and damp habitats.
Texosporium sancti-jacobi	Known from arid to semi-arid shrub-steppe, grassland, or savannah communities up to 3300 feet.
Thelenella muscorum var. octospora	Component of biological crust communities in semi-arid shrub steppe and grasslands.
Liverworts	**--**
Anastrophyllum minutum	On peaty soils above 5,500 feet elevation.
Anthelia julacea	On peaty soil above 5,000 feet. Grows in wet crags, on stream sides and areas where snow lies late in the year. In Oregon, often associated with low ericaceous shrubs.
Barbilophozia lycopodioides	On peaty soil over damp rock ledges and cliffs from 3,400 to 7,500 feet, generally where snowfall is high. Associated with *Abies lasiocarpa*, *Picea engelmannii*, and *Pinus contorta* forest types.
Preissia quadrata	On soil with little organic material, often on cliff ledges or in crevices in rocky areas.
Ptilidium pulcherrimum	Forming mats at the bases of trees, on decaying wood, among boulders in talus slopes, ledges of cliffs, and rarely on soil, in cool

Scientific name	Habitat
	moist *Pseudotsuga menziesii*, *Abies grandis*, *Abies lasiocarpa*, and *Picea engelmannii* associations.
Tritomaria exsecta	Damp mossy rocks and logs along creeks in coniferous forest.
Moss	**--**
Anoectangium aestivum	Moist cliffs, humid cliff crevices, and overhanging rocks.
Anomobryum julaceum	Cliff crevices on soil, cliff crevices, on tussock tundra with seeps and late snow melt areas, and on granitic outcrops.
Bruchia bolanderi	On moist soil in wet meadows and mixed conifer forests at approximately 3,500 to 6,640 feet in elevation.
Bryum calobryoides	On protected to exposed rock at moderate to high elevations. Can also grow on moist soil.
Elodium blandowii	Ground water fed wetlands, often calcareous. Also wet meadows and stream sides and seepage areas around alpine lakes.
Encalypta brevipes	Soil on ledges and in crevices on cliffs, reported from both igneous and siliceous substrates.
Entosthodon fascicularis	Grasslands, grassy balds, and rock outcrops on seasonally wet, exposed soil in seeps or along intermittent streams.
Mnium blyttii	Seepage areas along streamlets in subalpine and alpine areas and on calcareous, often humus-rich soil in mountains.
Orthotrichum bolanderi	Dry igneous and sedimentary rocks and faces of cliffs in areas with a Mediterranean climate. Forest types include *Pinus ponderosa and Pseudotsuga menziesii* associations.
Orthotrichum euryphyllum	Basalt rocks and outcrops around springs and streambeds. Primarily in dry *Juniperus occidentalis, Pinus ponderosa*, and *Artemisia tridentata* associations.
Orthotrichum holzingeri	On vertical calcareous rock surfaces and at the bases of Salix bushes just above rock that is frequently inundated by seasonally high water in dry coniferous forests.
Orthotrichum pellucidum	Insufficient knowledge on habitat. Found on both calcareous and non-calcareous rock boulders and cliff faces in very dry areas.
Pseudocalliergon trifarium	Medium to rich montane fens where it grows submerged to emergent in pools or on saturated ground, usually in full sunlight. Elevations range from 5,000 to 6,000 feet. Forest types include *Abies amabilis, Abies concolor,* and *Pinus contorta* ssp. *latifolia* associations.
Pseudoleskeella tectorum	On rock, usually calcareous, in dry, open and exposed locations, occasionally on logs or soil usually in calcareous areas in the mountains.
Ptilium crista-castrensis	Cold moist conifer forests. In Oregon, found in cold air drainage site within *Pinus contorta-Vaccinium scoparium* forest.
Schistidium cinclidodonteum	Wet or dry rocks or on soil in crevices of rocks and boulders, often along intermittent streams, at elevations of 5,000 to 11,000 feet.
Schistidium flaccidum	Rock in open to shaded habitats at 4,500 to 9,600 feet elevation.
Schistidium heterophyllum	Rock in open to shaded from 900 to 3,600 feet elevation.
Schistidium tenerum	Exposed dry rock outcrops and moist shaded soil in crevices at elevations between 5,700 and 6,700 feet.
Scouleria marginata	Volcanic or granitic bedrock or large boulders along the margins of perennial river systems; frequently submerged but is usually exposed during periods of low water flow.
Tetraphis geniculata	On large well-decayed logs in moist old-growth forests.

Scientific name	Habitat
Tortella tortuosa var. tortuosa	Calcareous rock or occasionally on dry soil in exposed locations.
Vascular Plants	**--**
Achnatherum hendersonii	Basalt lithosols; shallow rocky soils, sometimes with stiff sage, strict buckwheat, and ponderosa pine surrounding. Can be in deeper-soiled areas than Wallowa ricegrass.
Achnatherum wallowaense	Basalt lithosols; shallow rocky soils, sometimes with stiff sage, strict buckwheat, and ponderosa pine surrounding.
Artemisia arbuscula ssp. *longicaulis*	Shallow, clay soils with low available water-holding capacity, arid to-mesic soils. Areas with 5 to 12 inches precipitation per year. Probably only on extreme southern end of Malheur National Forest.
Astragalus diaphanus var. *diurnus*	Shallow gravely soil of sandbars or sandy banks of intermittent streams; often associated with juniper woodlands.
Astragalus misellus var. *misellus*	Dry grassland and sagebrush habitats.
Astragalus tegetarioides	Dry pine forest, sagebrush flats, on volcanic ash or basaltic substrates, cracks of welded tuff outcrops. In transition zone between sagebrush and ponderosa pine forest. Endemic to Emigrant Creek Ranger District (and west).
Botrychium ascendens	Partially shaded or open settings, primarily in sedge/forb communities associated with seeps, drainages, and edges of wet meadows. Engelmann spruce and stands of grand fir, Douglas–fir, and lodgepole pine.
Botrychium campestre	Very rare in Oregon; occurs primarily on well-drained soils in non-forested habitats.
Botrychium crenulatum	Partially shaded or open settings, primarily in sedge/forb communities associated with seeps, drainages and edges of wet meadows. Engelmann spruce and stands of grand fir, Douglas-fir, and lodgepole pine.
Botrychium hesperium	Grassy mountain slopes, snow fields, and road ditches, with willows, and sand dunes. Moist meadows, riparian, moist roadsides, openings, and edges of forests. Often on calcareous soils. Sometimes found in roadside ditches and at edges of lakes.
Botrychium lineare	Usually in and around the edges of wet meadows, in riparian areas, and moist roadside ditches. Forest types include moderate elevation mesic forests up to lodge pole pine and subalpine fir forests.
Botrychium lunaria	Open fields, occasionally forest in southern occurrences. Moist meadows, riparian zones, moist roadsides, openings, and edges of cold forests.
Botrychium montanum	Partially shaded or open settings, primarily in sedge/forb communities associated with seeps, drainages, and edges of wet meadows. Engelmann spruce and stands of grand fir, Douglas-fir, and lodgepole pine.
Botrychium paradoxum	Partially shaded or open settings, primarily in sedge/forb communities associated with seeps, drainages, and edges of wet meadows. Engelmann spruce and stands of grand fir, Douglas-fir, and lodgepole pine.
Botrychium pedunculosum	Mountain meadows, roadsides, brushy secondary woodlands, and open to closed canopy forests.
Calochortus longebarbatus var. *peckii*	Grassy margins of wet meadows, and under pines. Wet to moist meadows. Along stream edges. Often partially shaded by ponderosa pine. On basalt derived and volcanic ash soils.
Calyptridium roseum	Sagebrush desert to montane coniferous forest. Gravely to sandy soils, often in low moist swales among sagebrush. Often in alkaline soils.
Carex atherodes	Wet sites that remain wet through summer; lake margins, meadows, marshes, and ditches.

Scientific name	Habitat
Carex cordillerana	Riparian terraces, mesic forests, with grand fir and Douglas-fir. Aspen forests. Rocky slopes, in leaf litter and duff. Also in rocky areas with juniper and mountain mahogany.
Carex diandra	Lesser panicled sedge. Swamps, sphagnum bogs, lake margins, and wet, often calcareous meadows at moderate elevations.
Carex duriuscula	Dry prairies, sagebrush steppe, and open forest.
Carex idahoa	Flat to gently sloping meadows around headwater streams and springs. Often with *Carex praegracilis* and/or *Poa pratensis*. In ecotone between wetlands and uplands. Sub irrigated soils that dry out in summer.
Carex lasiocarpa var. *americana*	Swamps and wet meadows at mid elevations. Found on the Deschutes National Forest along the Deschutes River, south of Bend.
Carex media	Montane to subalpine meadows, streambanks, seepage areas, and bog margins. Mossy, moist forests.
Carex retrorsa	Wet meadows, bogs, swamps, and edges of streams, lakes, and rivers. Foothills and lowlands. ORNHIC data elevations range from 10 3,000 feet.
Cheilanthes feei	Located in crevices on cliffs. Known from northeastern Oregon.
Cicuta bulbifera	Marsh edges, slow moving streams, lake margins, bogs, wet meadows, and shallow standing water.
Cryptogramma stelleri	Sheltered calcareous cliff crevices and rock ledges, typically in coniferous or boreal forest. On wet cliffs, and ledges, along streams, under waterfalls. Limestone substrate. Shady sites. Usually north-facing aspects.
Cymopterus nivalis	Open rocky places. Moderate to high elevations. Found on volcanic tuffs and bald areas with less than 30% vegetation cover. *Artemisia arbuscula* is a common associate.
Cypripedium fasciculatum	Warm, shady, riparian conifer forests usually with *Abies grandis* or *Pinus ponderosa*.
Elatine brachysperma	Mudflats, shallow pools, and pond edges.
Eleocharis bolanderi	Vernally wet swales, along intermittent streams, wet depressions in moist meadows and lithosols. In slight depressions that hold snow later in the season than surrounding areas. Surrounding forest is usually ponderosa pine. Habitat and plants are dry by mid-summer.
Eremothera pygmaea	Open bare ground in dry plains and slopes with unstable soils or in gravel in steep talus, dry washes, and road cuts.
Eriogonum cusickii	Rocky sagebrush desert. Barren flats and hills with dry soil over weathered basalt and welded tuff. Associated species include low sage and juniper. Only suspected on Emigrant Creek Ranger District.
Eriogonum salicornioides	On sparsely vegetated, open, ash deposits, and clayey substrates, sometimes in disturbed areas. Saltbush, greasewood, and sagebrush communities; juniper woodlands possibly surrounding.
Erythranthe inflatula	Vernally moist sites and fluctuating banks of intermittent streams or pools in sagebrush-juniper zone.
Heliotropium curassavicum	Wet ground, saline flats, and alkaline soils. Dried edges and centers of vernal pools. Low to moderate elevations.
Ipomopsis tenuituba	High elevation sagebrush and subalpine openings.
Isoetes minima	Vernal pools, lake margins, and seasonally wet seeps and swales.
Lipocarpha aristulata	Sandbars and wet bottomlands.
Listera borealis	Moist, rich soils in shady coniferous forests; along cold streams with old spruce and true firs.
Lomatium erythrocarpum	High elevation ridges, fine argillite talus, and open slopes that are usually steep.

Scientific name	Habitat
Luina serpentine	Open, rocky sites with poor soil development. Usually on steep slopes, above small tributaries. In dry shrub, open juniper, ponderosa pine, and Douglas-fir forest areas.
Lupinus lepidus var. *cusickii*	Residual soils from ancient lakebeds, volcanic ash, and clay soils. Barren tuffaceous or gravelly clay bluffs and gullied riverbanks. Plants often in eroded drainage channels.
Lycopodium complanatum	Edges of wet meadows; dry, forested midslope with 25% canopy cover.
Muhlenbergia minutissima	Weathered lava soils in riparian; only ORNHIC site in Oregon is Jordan Crater, Malheur County.
Myosurus sessilis	Vernally wet sites and alkali flats.
Ophioglossum pusillum	Dune deflation plains, marsh edges, vernal ponds, and stream terraces in moist meadows.
Pellaea bridgesii	Rocky slopes and cliffs, on granitic substrate. Talus slopes, scree, and rock outcrops; often on southern exposures on argillite in Wallowa and Blue Mountains.
Penstemon deustus var. *variabilis*	Dry foothills and lowlands on open dry thin soils.
Phacelia minutissima	Moist, open places, streambanks, meadows, and ephemerally moist swales. Vernally moist openings in ponderosa pine or Douglas-fir forest. Often with Veratrum. In aspen in Washington.
Phlox multiflora	Basalt cliffs, rocky outcrops and bluffs, rocky openings, and wooded rocky areas in dry forest. Sometimes on loose substrate as well as cracks in cliffs and rock outcrops. Highest elevation in Oregon is 4,800 feet, however found higher up in Rocky Mountains.
Pilularia americana	In mud around edges of shallow vernal pools.
Pleuropogon oregonus	Open, wet meadows, marshes, and riparian areas. Grows in areas of standing or flowing water early in season. Documented sites not near forested habitats. Sluggish water in depressions and sloughs, irrigation ditches.
Potamogeton diversifolius	Aquatic; shallow creeks and ponds. Shallow water, ditches, ponds, and lakes.
Potamogeton foliosus ssp. *fibrillosus*	Warm shallow lakes, springs, streams, and rivers.
Pyrola dentate	Found in mixed conifer forests, forested serpentine, and volcanic areas, hillsides of decomposed granite or loose, coarse sand, or gravel near rocky outcrops.
Rorippa columbiae	Wet to vernally moist sites; meadows, fields, playas, lakeshores, intermittent stream beds, banks of perennial streams, along irrigation ditches, river bars and deltas.
Rotala ramosior	Damp areas in fine silt and sand, wet swampy places, mudflats, lake and pond margins, and along free-flowing river reaches.
Salix farriae	Wet meadows, stream banks, moderate to high elevations
Salix wolfii	Riparian, wet meadows, waterfalls, stream-sides, moist shrub lands; moderate to high elevations.
Senecio sphaerocephalus	Moderate elevation wet meadows.
Stanleya confertiflora	Dry plains and low sand or clay hills. On barren clay and diatomaceous soils in sagebrush habitats. Sometimes with juniper.
Thelypodium eucosmum	Under and around western juniper, ponderosa pine, and Douglas-fir trees; in canyons, seasonal creek drainages, and seeps/springs. Also found in vernally

Scientific name	Habitat
	moist areas in ponderosa pine forests and in sage. Restricted to serpentine and ultramafic derived soils on Malheur National Forest.
Thelypodium howellii ssp. *howellii*	Moist plains or river valleys.
Trifolium douglasii	Moist or mesic meadows, prairie remnants, along riparian areas along streams. In swales, along intermittent streams, and in vernally wet areas.
Triglochin palustris	Meadows, mud flats, and gravelly stream margins; often where brackish or alkaline.
Trollius laxus ssp. *albiflorus*	Swamps to alpine meadows.
Utricularia minor	Occurs underwater in lowland and montane fens, sedge meadows, low-nutrient lakes, and peatbog pools.